(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
10 September 2004 (10.09.2004)

PCT

(10) International Publication Number
# WO 2004/077436 A1

(51) International Patent Classification⁷: G11B 27/10, H04N 7/24

(21) International Application Number:
PCT/IB2004/050135

(22) International Filing Date: 20 February 2004 (20.02.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
03075566.4 25 February 2003 (25.02.2003) EP
03103263.4 1 September 2003 (01.09.2003) EP

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(54) Title: DATA MEDIUM

(57) Abstract: Data medium adapted to triggering applications in response to an event. The data medium comprises a plurality of play-items and at least one event-item containing an even function call. Further the data medium comprises a play-list for determining the order, in which the play-items and the event-item are read out of the data medium.

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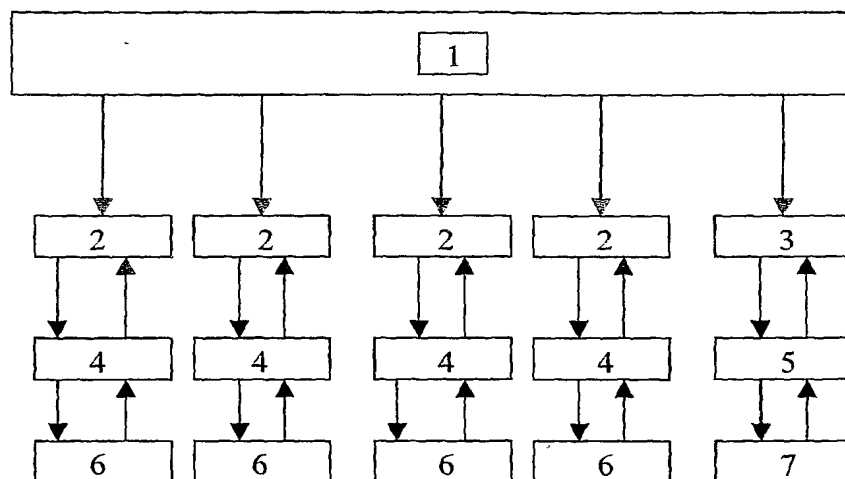PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

**Published:**
— *with international search report*

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Data Medium

The present invention is concerned with data media adapted to triggering applications in response to an event, methods for triggering applications in response to an event and devices adapted to reading and processing the data from a data media adapted to triggering applications .

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The development of data carrier for providing video and/or audio content to a consumer has been marked by an ever increasing demand in the storage capacity of such data carriers and the demand for interactivity. In order to meet these demands new data media are being developed in particular blue-ray discs. Furthermore more and more interactive

10        applications are being introduced to such storage media. A new publishing format is being designed for blue-ray discs which allows picture quality in HDTV resolution and improved interactivity.

A particular desire is to provide a synchronization between video content and a computer application such as a Java application, such that the application is triggered, if an

15        event occurs in the content of a video during playback. For example, if a movie reaches an important scene during playback, an application is triggered which displays additional information on the scene from the director. Another example for an event can be the scoring of a goal, if a sports match is being displayed. The application can be triggered to change the score of the match.

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The prior art document WO 02/05104 addresses this above mentioned problem but fails to disclose a workable solution. WO discloses on page 61 the use of events, which are integral to synchronizing DVD-Video with other media. But the document does

25        not disclose how different events in particular time events in the content of the DVD may trigger an application.

It is therefore object of the present invention to provide a solution for triggering an application in response to the play-back of an event in the content of a data medium.

The problem is solved by a data medium adapted to triggering applications in response to an event comprising a plurality of play-items, at least one event-item containing an event function call and a play-list for determining the order, in which the play-items and the event-item are read out of the data medium. The play-items correspond to the applications and data contained on the data medium, among which a user of the data medium can choose.

The triggering of the application can be effected by the user of the data medium, who may choose from the play-list, which play-items shall be played back from the data medium. Further triggering may be effected by changing the state of the data medium. An example for the change in the state of the data medium is a change of a playback rate of the data medium. The play list may be programmed in this case to immediately execute the event-item containing the event function, which in turn triggers the application.

If there is no special request from the user of the data medium, the play-list will read out the play-items in a predetermined order. The event-item will be read at the beginning, end or in between any two successive play-items. The application is triggered in response. Therefore the event triggering the application is the beginning of playback, the end of playback or the change between two play-items. The event triggering the application may be defined as a change in the play-items being played back form the disc. The event-item contains event information relating to the change between the play-item preceding the even-item and/or the play-item succeeding the event-item.

Different event function calls may correspond to different events whereupon the event-item is read from the data medium. Therefore, the nature of the event may be discerned by the kind of function which is being called. Different events may call for different functions. For example the event of a goal in a game calls for a function for determining the score of a game. The event of a scene change in a movie may call for an event function for displaying additional information about the movie in particular the scene displayed. The application to be executed must therefore be known at the time of the authoring of the data medium, if the data medium may only be written once.

According to another embodiment the even-item contains event information relating to the event whereupon the event-item is read out of the data medium. The function being called in response to different events may be the same. The information contained in the event-item may be transferred to the function. This event information may in turn be used

to trigger specific applications. The nature of the event may be easily discerned by the calling application, which in turn may execute further applications in response to the event information received.

The data medium is preferably a blue-ray disc, since blue-rays provide for play-lists and play items according to the international standard ISO/IEC 1381 for blue-ray disc publishing. The event function call may be adapted to registering to a computer application, in particular a Java application, an HTML application, an XML application or a C-application. The play-items typically contain audio and/or video data.

The problem of the invention is solved in particular by a method for triggering applications in response to an event characterized by the steps reading event-items and play-items from a data carrier in the order determined by a play-list stored on the data carrier and executing an event function in response to reading an event function call contained in the event item. This is the method, which must be carried out by a storage medium reading device, which is adapted to reading the data medium previously discussed.

Another solution to the problem of the invention is a data medium comprising at least one clip-stream file having a plurality of first elementary streams and at least a second elementary stream, wherein the first elementary streams are video and/or audio streams and the second elementary stream is a private stream containing code segments. The coding mechanism must allow private streams to be embedded in the data stream, which is to be decoded. Such a coding mechanism is provided for example by the MPEG2 standard for coding video and/or audio-data. The first elementary streams form a contiguous data stream, if read from the data medium. MPEG2 multiplexes the first elementary streams, which contain audio and/or video data. The private stream contains data which are not encoded according to the MPEG2 standard. The code segments may contain java class file, which when loaded run in the Java virtual machine and can be used to display information to the user on the event. Furthermore the code segments may constitute function calls which transfer data about the event and the time of the event to the application registered to the function call.

Preferably the first elementary streams are encoded in such a way that the first elementary streams are multiplexed to form a coherent clip-stream, when read from the data medium. The normal play time is linked to the clip-stream and the normal play time is indicative of the time in the clip-stream. Normal play time is a time line linked to the coherent clip-stream. The timeline is continuous over the duration of the clip stream. The normal play time refers to the real time of the stream content regardless of the mode of it's

presentation. For example, when a video is played in reverse normal play time counts down rather than up and when a video is played at ten times the speed normal Play time progresses at ten times the regular rate. Therefore a point in time in normal playtime is always indicative of a certain, unalterable event in the content of the clip stream. An application can be

5      triggered in response to an event in the content, if the point in time in normal play time is known, at which the event takes place. Therefore the code segments may contain simply the time in normal play time and the name of the event taking place. This information can be transmitted before the event actually takes place. Triggering the application in response to an event may simply be achieved by monitoring the normal play time of the clip-stream.

10           The point in time in normal play time may be determined by any data medium drive which has a system clock. The length of the clip-stream in normal play-time corresponds to the number of clock cycles needed to display the clip stream at a predetermined "normal" speed. If the clip is displayed faster, the normal playtime may be calculated from the difference in speed.

15           A stream event descriptor is a function call which contains the data relating to an event in the content of the stream and a point in time of the event in the normal play-time. By implementing stream event descriptors on the data medium, the triggering of the application may be achieved synchronously with the occurrence of an event in the content of the data medium.

20           The second elementary streams may be encoded in such a way that the second elementary streams are multiplexed to form a coherent private-stream, when read from the data medium. The normal play-time is linked to the private stream and the normal play-time is indicative of the time in the private-stream. If the private stream and the clip stream are processed simultaneously, the code segments in the private stream having the same point in

25      time in normal play-time will be executed simultaneously with the events in the clip-stream. Thus applications, which are registered to the code segments, are executed simultaneously with events in the clip stream. The code segments preferably constitute function calls for example in Java.

           The solutions of embedding a function call in a play list and in a clip stream

30      file may be combined with each other. Depending on the kind of event, the synchronization of the event can be achieved by including a function call in the clip stream file or in the play list. If an application is only related to a single piece of content, it is typically event driven and embedding a function call in the clip stream file is the preferred solution. Applications

that deal with multiple clip streams such as an application that allows a user to view multiple angles of a camera shot are typically linked to the play-list.

The applications linked to events in the content of a data medium according to the invention may also access data on the data medium such as image frames. The data to be

5    accessed may also be embedded in clip stream files as private streams. The private stream may represent images or even HTML or XML files. The normal transfer of data between the CPU and a peripheral device may be used. A set of APIs (Application Protocoll interface) for file read and write access may be implemented, in order to allow the application to read data from the disc. APIs are implemented by writing function calls in the program, which provide

10   the linkage to the required subroutine for execution.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter. The preferred embodiments of the present invention are discussed by way of example with reference to the accompanied drawings.

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Fig. 1 shows the data structure of a data medium according to a first embodiment of the present invention,

Fig. 2 shows the first and second elementary streams of a clip-file contained in

20   the data medium according to a second embodiment of the present invention before multiplexing,

Fig. 3 shows the private stream and the clip-stream after multiplexing according to the second embodiment of the present invention.

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The data structure shown in Fig. 1 consists of a play-list 1, which is associated with a number of play-items 2 and an event item 3. The play-items 2 are each associated with a respective clip info file 4. The clip info files contain information about respective clip-stream files 6. Information about the coding conditions of the stream files and a mapping of

30   the normal play time and the location in the stream may also be included in the clip info file. They indicate in particular where the clip stream data is stored on the data medium. Audio/Video data is stored in the clip-stream files 6 according to the MPEG-2 transport stream format used in digital TV broadcasts. The transport stream format provides for a better error correction than the standard program stream format. Associated with each clip

stream file 6 is a clip info file , which stores additional information about the audio/video data to support playing back of the clip. Separate from the clip layer is the play list layer, which defines the actual play list the user can play. Each play list 1 comprises one or more play items 2 and each play item points to a continuous piece of MPEG-2 transport stream in a

5 clip file.

The play file also points to an event item 3. The play list determines the order, in which the items 2 and 3 are read out of the data medium. The event item 3 may be executed in any chosen order according to the play list 1. The event item is connected to an event info file 5, which contains information about the location and kind of data stored in the

10 event file 7. The event file 7 contains a specific function call to be executed. At the time the event item 3 is activated by the play list 1, the function call is executed. As a consequence an application registered to the function call is executed.

In Fig. 2 a number of the first elementary streams 20 is depicted. The first elementary streams 20 contain audio/video data encoded according to the MPEG-2 standard.

15 Furthermore, a second elementary stream 21 is depicted in Fig. 2. The first and second elementary streams are associated with a clip info file 4 (not shown). The clip info file contains information about the location of the elementary streams 20 and 21 on the disc and information about the nature of the elementary streams (MPEG-2 or private stream). The second elementary stream 21 is a private stream which contains a function call and the time

20 of the function call in normal play time (NPT).

In Fig. 3 the first and second elementary streams 20 and 21 are shown after multiplexing according the MPEG2-standard. The first elementary streams now form a contiguous clip stream file of video and or audio data. The normal play time (NPT) associated with the clip stream is depicted on the x-axis below the clip stream. The only

25 second elementary stream forms the private stream shown above the clip stream. The position of the first and second elementary stream with respect to the x-axis determines the time when the respective streams are played back (clip stream) or executed (private stream). Therefore the function call contained in the private stream is executed simultaneously with an event contained in the region of the contiguous clip stream below the second elementary stream.

30 It is apparent to the person skilled in the art, that the previous embodiments of the invention are only exemplary and that the invention may be carried out in ways differing from the previous embodiments. The claimed invention is defined by the appended claims. Reference signs in the claims shall not be construed as limiting the scope of protection.

CLAIMS:

1.        Data medium adapted to triggering applications in response to an event
comprising

a plurality of play-items (2),

at least one event-item (3) containing an event function call and

a play-list (1) for determining the order in which the play-items (2) and the
event-item (3) are read from the data medium.

2.        Data medium according to claim 1, characterized in that the different event
function calls correspond to different events whereupon the event-item (3) is read from the
data medium.

3.        Data medium according to claim 1 or 2, wherein the even-item (3) contains
event information relating to the event whereupon the event-item (3) is read from the data
medium.

4.        Data medium according to claim 1, characterized in that the event-item (3)
contains event information relating to the change between the play-item (2) preceding the
even-item (3) and/or the play-item (2) succeeding the event-item (3).

5.        Data medium according to one of the previous claims, characterized in that the
play-list (1) is adapted to changing the predetermined order, in which the play-items (2) and
the event-item (3) are to be read from the data medium, if a state of the data medium changes,
wherein the event-item (3) is to be read first and the event-item (3) contains event
information relating to the change of the state of the data medium.

6.        Method for triggering applications in response to an event characterized by the
steps,

reading event-items (3) and play-items (2) from a data carrier in the order
determined by a play-list (2) stored on the data carrier,

executing an event function in response to reading an event function call contained in the event item (3).

7.        Data medium comprising at least one clip-stream file having a plurality of first elementary streams (20) and at least a second elementary stream (21), wherein the first elementary streams (20) are video and/or audio streams and the second elementary stream (21) is a private stream containing code segments.

8.        Data medium according to claim 7, characterized in that the first elementary streams (20) are encoded in such a way that the first elementary streams (20) are multiplexed to form a coherent clip-stream, when read from the data medium, a normal play time (NPT) is linked to the clip-stream and the normal play time (NPT) is indicative of the time in the clip-stream.

9.        Data medium according to claim 8, characterized in that the second elementary stream (21) contains a stream event descriptor having data relating to an event in the content of the stream and a point in time of the event in the normal play-time (NPT).

10.        Data medium according to claim 8, characterized in that the second elementary streams (21) are encoded in such a way that the second elementary streams (21) are multiplexed to form a coherent private-stream, when read from the data medium, the normal play-time (NPT) is linked to the private stream and the normal play-time (NPT) is indicative of the time in the private-stream.

11.        Device adapted to reading and processing the data from a data medium according to one of the claims 7 to 10.
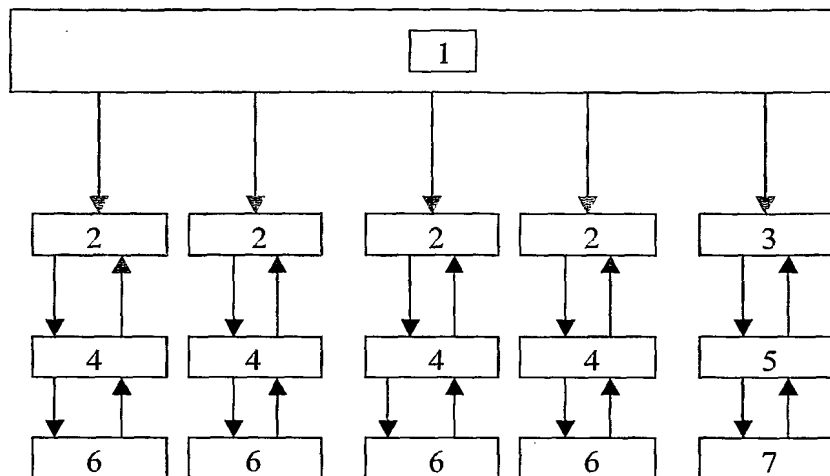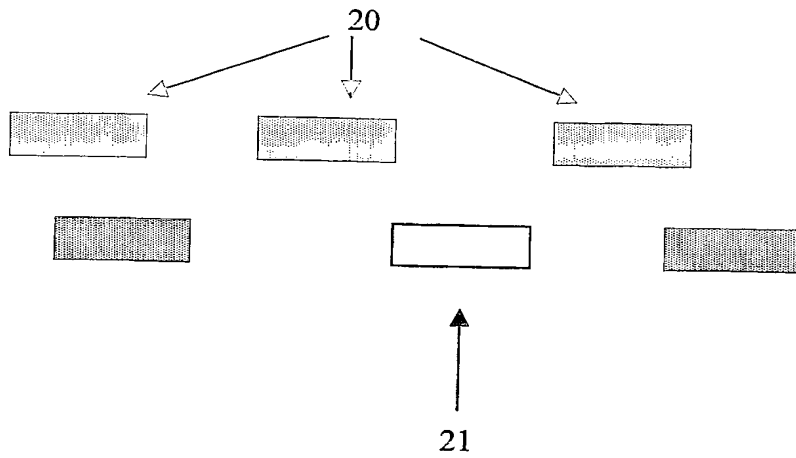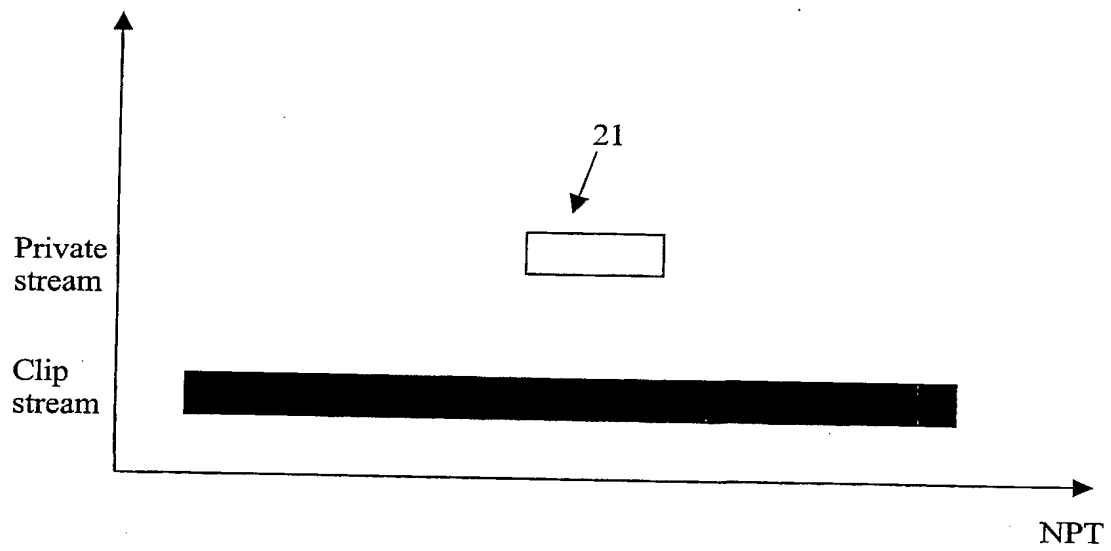
FIG.1

FIG.2



FIG.3

# INTERNATIONAL SEARCH REPORT

**A. CLASSIFICATION OF SUBJECT MATTER**
IPC 7   G11B27/10    H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   G11B   H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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| X | US 2002/194618 A1 (NAKAMURA KAZUHIKO ET AL) 19 December 2002 (2002-12-19) | 1-6 |
| A | paragraphs '0152!, '0218!, '0240!, '0289!, '0311! – '0331! figures 10,18,23,30 | 7-11 |

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| X | Further documents are listed in the continuation of box C. | | X | Patent family members are listed in annex. |

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"A" document defining the general state of the art which is not considered to be of particular relevance

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 24 May 2004 | 04/06/2004 |

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| European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016 | Maetz, A |

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